



# Update on Small Modular Reactors A Canadian Regulatory Perspective

**Lisa Thiele**

Senior General Counsel, Canadian Nuclear Safety Commission

Working Party on Legal Aspects of Nuclear Safety (WPLANS)

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# Overview

- Regulatory Approach
- Small Modular Reactors
- Regulatory Readiness
- Vendor Design Review
- International Collaboration
- General Takeaways



# Safety: The Cornerstone of the CNSC Mandate

## **Subsection 24(4) of the *Nuclear Safety and Control Act (NSCA)***

*No licence shall be issued, renewed, amended or replaced ... unless, in the opinion of the Commission, the applicant ...*

- (a) is qualified to carry on the activity that the licence will authorize the licensee to carry on; and*
- (b) will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.*



# Regulatory Approach

## The CNSC establishes safety requirements

- CNSC regulatory philosophy is flexible in that it allows a proponent to propose how the design will meet a performance requirement

## Graded approach

- Requirements needed in order to be safe are commensurate with risk
- There is no relaxation of requirements – higher levels of uncertainty lead to increased safety and control measures

## Combination of management, performance-based and prescriptive approaches

**Alternative approaches can be used to meet the intent of many regulatory requirements**

# The Current Regulatory Framework Is Fit For Reviewing Advanced Reactors



# Small Modular Reactors (SMR)

## Significant interest in Canada

- Potential uses
  - Providing energy to northern and remote communities
  - Power source for mining/industrial operations
  - Grid connected power generation
- Utility, Federal and Provincial governments' interest
- Canadian Nuclear Laboratories (CNL) – Request for Expression of Interest (RFEOI) for SMR demonstration project. Proposes to host an SMR by 2026
- New Brunswick Government investing in nuclear research cluster



# PAN-Canadian SMR Roadmap

- Led by Natural Resources Canada (NRCan), responds to October 2017 Standing Committee report on nuclear energy
- Brought together Federal, Provincial/Territorial governments, utilities, key stakeholders in a 10-month engagement process – CNSC participated as an observer, whose main role was to provide advice on regulatory matters
- Canada's regulatory framework and waste management regime are well-positioned to respond to the SMR paradigm shift, with some necessary modernization to reflect the reality of the smaller size of an SMR
- November 7 2018: NRCan launched ***A Call to Action: A Canadian Roadmap for Small Modular Reactors*** – <https://smrroadmap.ca/>
- Recommended Vision for Canada's SMR Action Plan: SMRs as a source of safe, clean, affordable energy, opening opportunities for a resilient, low-carbon future and capturing benefits for Canada and Canadians
- The priority recommendations of the ***Roadmap***:
  - Pillar 1. Demonstration and Deployment
  - Pillar 2. Policy, Legislation, and Regulation
  - Pillar 3. Capacity, Engagement, and Public Confidence
  - Pillar 4. International Partnerships and Markets

**CNSC has a mandate to disseminate information on Canadian regulatory requirements, processes**



# PAN-Canadian SMR Roadmap (continued)

## Pillar 2. Policy, Legislation, and Regulation

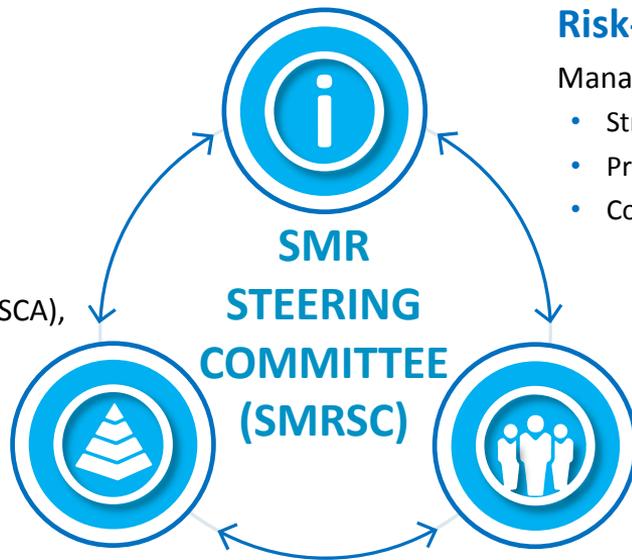
- **Federal impact assessment:** The new *Impact Assessment Act* (Bill C-69) should address specific impact of a project, not policy. Projects for SMRs equal to or below 300 MWe should be excluded from Project List, in recognition of low risk for potential adverse environmental effects in areas of federal jurisdiction.
- **Nuclear liability:** The federal government (NRCan) should review regulations under the *Nuclear Liability and Compensation Act* to ensure nuclear liability limits for SMRs are aligned with risks they pose, using a graded scale based on risk-informed criteria.
- **Regulatory efficiency and nuclear security:** The CNSC should engage with industry, public, and Indigenous peoples on *Nuclear Security Regulations* amendments to ensure a graded approach based on risk-informed criteria. This recognizes that, while the regulatory framework is sound and ready for the safe deployment of SMRs, there are efficiencies that could be pursued to provide further flexibility and clarity in SMR licensing and regulation.



# Elements of Regulatory Readiness Strategy

## Regulatory framework

*Nuclear Safety and Control Act (NSCA), regulations, licences, regulatory documents*



## Risk-informed processes

Managed processes covering:

- Strategic decision making
- Pre-licensing and licensing compliance
- Continuous improvement

## Capable and agile staff

- Capacity/capability
- Training
- International cooperation

## Established Processes For Enabling Decisions For Regulation



# Regulatory Readiness

## Enhancing and streamlining our framework

- Currently, regulations under the *Nuclear Safety and Control Act* are **already suitable** for regulating SMRs
- The CNSC is actively working to further improve the existing regulatory framework
  - **CNSC discussion paper DIS-16-04**, *Small Modular Reactors: Regulatory Strategy, Approaches and Challenges* was published in 2016
  - **Draft REGDOC-1.1.5**, *Licence Application Guide: Small Modular Reactor Facilities*  
Public consultation closed 28 September 2018; feedback on comments received closed on November 20  
All comments currently being considered; anticipated publication: Spring 2019
  - **Nuclear Security Regulations** are being amended to be more flexible and better accommodate SMR facilities

**All Regulatory Requirements Are Covered  
Under Current Framework**



# Vendor Design Review

## What is a VDR?

- It is an optional assessment of a nuclear power plant design based on a vendor's reactor technology
- It is not a certification process and is not a licence – it does not constitute an approval of a design
- Its objective is to verify the acceptability of a nuclear power plant design with respect to Canadian nuclear regulatory requirements, codes and standards

## Benefits

- Identify and address regulatory issues early to minimize delays in licensing and facility construction
- Higher-quality licence applications
- Efficient and effective licensing process
- Assists decision makers in quantifying project risks (informing cost and schedule estimates)
- Provides regulatory clarity on the expectations of the CNSC



# Vendor Design Reviews and Licensing Process

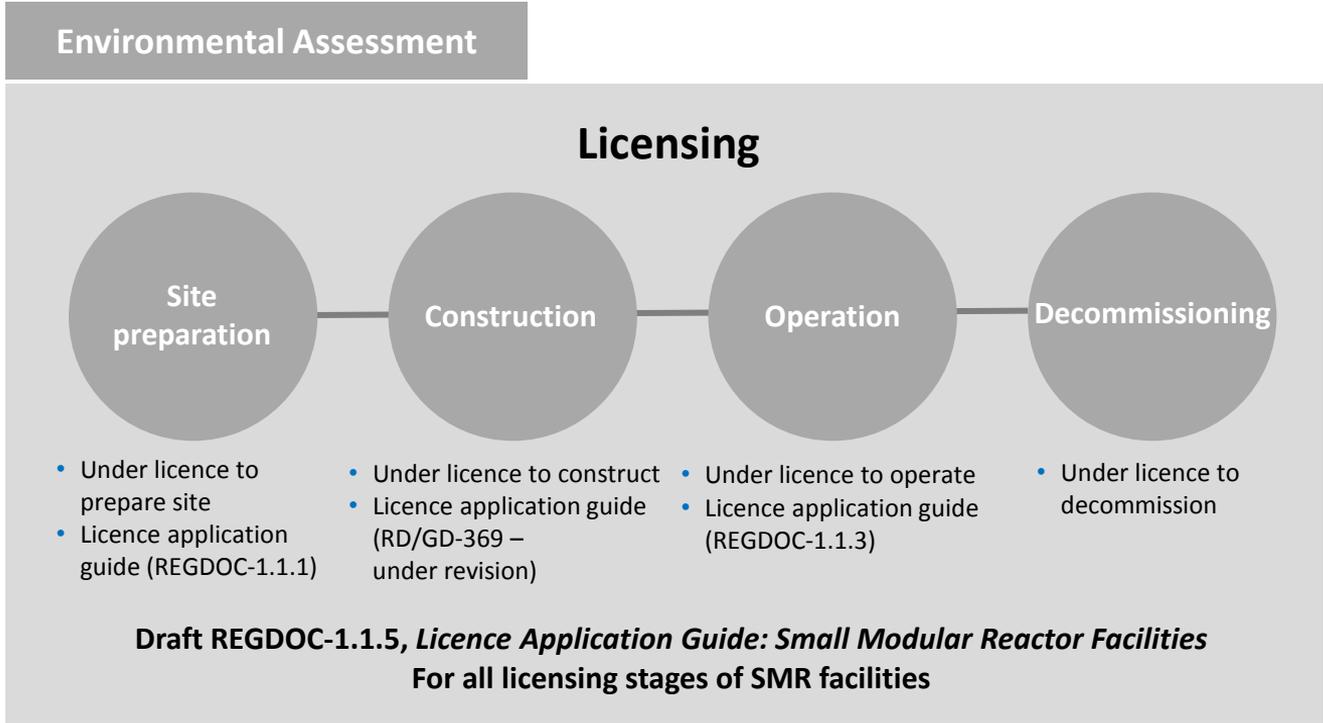
## Optional pre-licensing



- Reactor vendor
- GD-385, *Pre-licensing Review of a Vendor's Reactor Design*



- Potential applicant





# VDR Assessment Phases



- Conceptual design largely completed
- Vendor demonstrates understanding of CNSC design requirements and shows how their design, as it is evolving, would be able to meet CNSC requirements

- Basic engineering program is either well underway or completed. Vendor demonstrates:
  - through design processes and system level design information that the design is capable of meeting CNSC requirements
  - how sufficient evidence is being generated to support safety claims
- The CNSC identifies where potential fundamental barriers to licensing may exist or are emerging in the design

- Vendor seeks more information or clarification from the CNSC about a Phase 2 topic, and/or
- Vendor asks the CNSC to review activities undertaken towards design readiness, following the completion of Phase 2
- Phase 3 VDR activity and scope is vendor-driven, based on need



# Vendor Design Reviews in Progress

VDR No.	Country of origin	Company	Reactor type
1	Canada / U.S.	Terrestrial Energy (IMSR-400)	Molten salt / 200 MWe
2	U.S. / Korea / China	Ultra Safe Nuclear/Global First Power	High-temperature gas prismatic block / 5 MWe
3	Sweden / Canada	LeadCold	Molten lead pool fast spectrum / 3-10 MWe
4	U.S.	Advanced Reactor Concepts	Sodium pool fast spectrum / 100 MWe
5	UK	U-Battery	High-temperature gas prismatic block / 4 MWe
6	UK	Moltex Energy	Molten salt fast spectrum / ~300 MWe
7	Canada / U.S.	StarCore Nuclear	High-temperature gas prismatic block / 10 MWe
8	U.S.	SMR, LLC. ( a Holtec International Company)	Pressurized water / 160 Mwe
9	U.S.	NuScale Power	Integral pressurized water / 50 Mwe
10	U.S.	Westinghouse Electric Co.	eVinci Micro Reactor / <25 MWe



# Determining Appropriate Licensing Strategy

## Applicants

**Potential licensees (applicants) are encouraged to consult with the CNSC early**

- Discuss the nature of the proposed application
- CNSC can consider the appropriate approach and strategy to deal with all safety and control areas and advise the applicant of the CNSC's expectations

**Applicant needs to ensure that all the licensing requirements are met**

- Engagement with the public and potentially impacted Indigenous groups
- Environmental considerations
- Site security
- Emergency planning



# International Collaboration on SMRs



**The CNSC and Government of Canada are cooperating and sharing information with a number of countries on SMR technologies**

Working closely with IAEA and the NEA on sharing best practices in the regulation of SMRs

Working bilaterally with a number of countries (e.g., United States, United Kingdom)

Leveraging the experience of others - CNSC technical review can be informed by other regulators' assessments



# International Collaboration on SMRs

## **Nuclear Energy Agency:**

- Multinational Design Evaluation Program (MDEP)
- Group on the Safety of advanced Reactors (GSAR)
- Working Group on the Regulation of New Reactors (WGRNR)

## **International Atomic Energy Agency:**

- Exploring implications of SMRs on existing requirements



# Some General Takeaways

- The CNSC is an independent regulator that continues to support government initiatives in the area of SMRs.
- The CNSC's regulatory framework is robust, flexible and based on decades of operating experience that can be applied to advanced reactor technologies.
- The CNSC's regulatory framework and internal processes are risk-informed and can be used to license advanced reactors. The framework allows for the proposal of alternatives and the use of grading.
- Reactor designs may be innovative, but must be based on solid nuclear safety and engineering practices.
- Vendor design reviews are a well-respected and useful service.
- CNSC staff are actively engaging with stakeholders to ensure clarity of requirements and expectations.

**We Will Never Compromise Safety**

**Thank You!**

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